The Art of Soldering

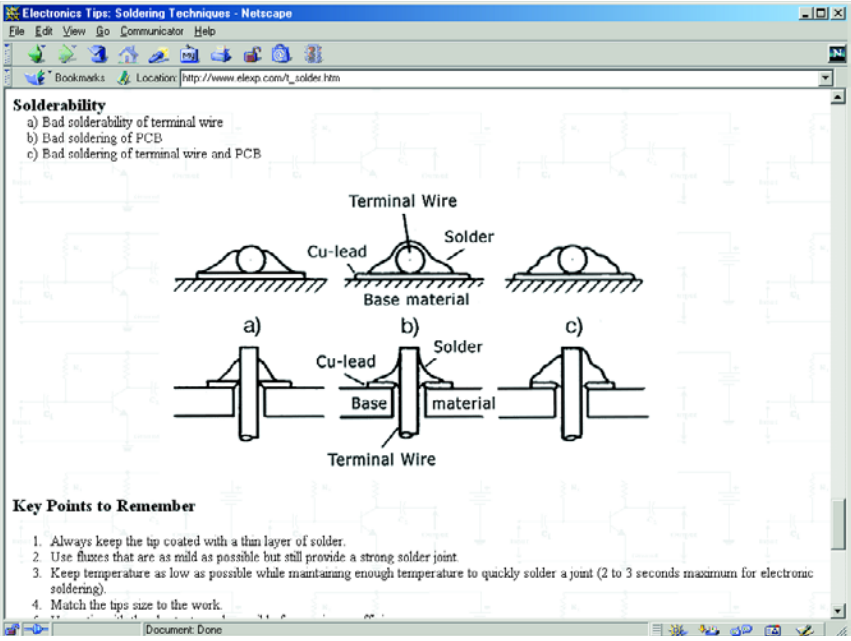
Making proper solder joints

By Harry Baggen

Building up electronic circuits usually involves interconnecting all components using wires or circuit board tracks. Whatever the method, solder joints are used to ensure good mechanical stability and the best possible electrical conduction. Manual soldering is not difficult once you have some experience. If you are not too confident about your own skills in this area, a lot can be learned from articles and mini courses published on the Internet.

Many readers of this magazine will have done a lot of soldering in their lifetime, so they probably need not be told that good soldering skills are required if you want to repair electronics equipment or build your own using components, wires and/or a circuit board. And yet, it may be a good idea to have a good look at your solder joints, because their quality is of the utmost importance. Typical errors are (1) using far too much solder tin and (2) insufficient heating of the joint. Both imperfections can have negative consequences, maybe not straight away but certainly after some time, when you suddenly find that an electrical joint has developed a high junction resistance, or a component pin has come loose owing to mechanical stress or thermal effects.

Arguably, it makes sense for experienced engineers as well as for beginners to cast a critical eye over their soldering work. In order to help you, and supply some additional information, this month's instalment of Electronics On-Line concentrates on soldering courses on the Internet. In the process of searching for relevant information, we came across some quite useful information we'd like to share with you.


Electronics Tips: Soldering Techniques - Netscape
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Bookmarks
Location: http://www.elexp.com/t_solder.htm
Terminal Wire
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Base material
a)
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Cu-lead
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Solderability

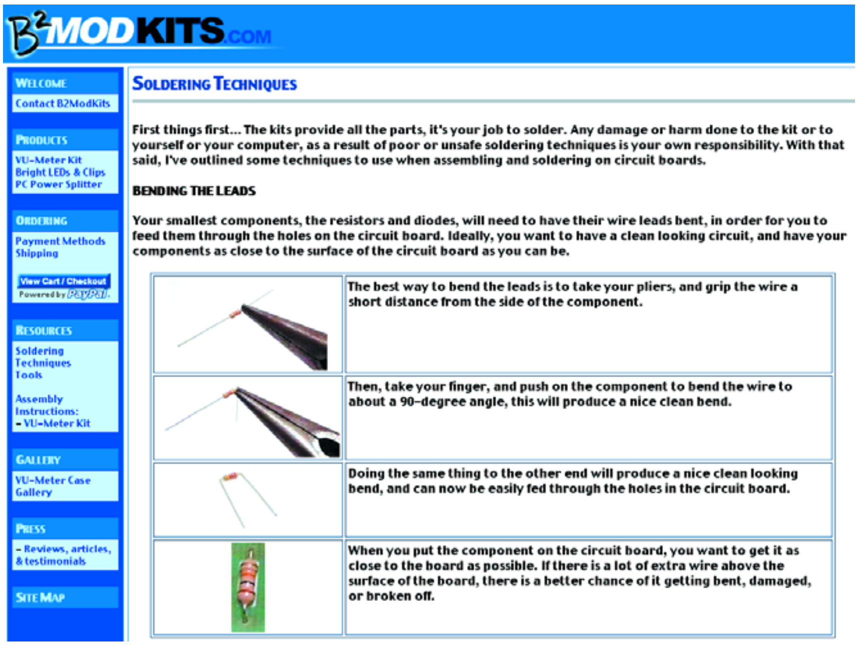
a) Bad solderability of terminal wire
b) Bad soldering of PCB
c) Bad soldering of terminal wire and PCB

Key Points to Remember

1. Always keep the tip coated with a thin layer of solder.
2. Use fluxes that are as mild as possible but still provide a strong solder joint.
3. Keep temperature as low as possible while maintaining enough temperature to quickly solder a joint (2 to 3 seconds maximum for electronic soldering).
4. Match the tips size to the work.

For a short, no-frills approach to the subject it is best to start at the **B2ModKits** web pages [1], where ten pictures and some explanatory text describe the skill called soldering.

A more extensive story we would certainly recommend is the 'Online Soldering School' published at Benchmarks, **The Electronics Technician's Web page** [2]. The process of soldering is examined in a number of steps, from the size of the soldering iron right up to desoldering com-



SOLDERING TECHNIQUES

First things first... The kits provide all the parts, it's your job to solder. Any damage or harm done to the kit or to yourself or your computer, as a result of poor or unsafe soldering techniques is your own responsibility. With that said, I've outlined some techniques to use when assembling and soldering on circuit boards.

BENDING THE LEADS

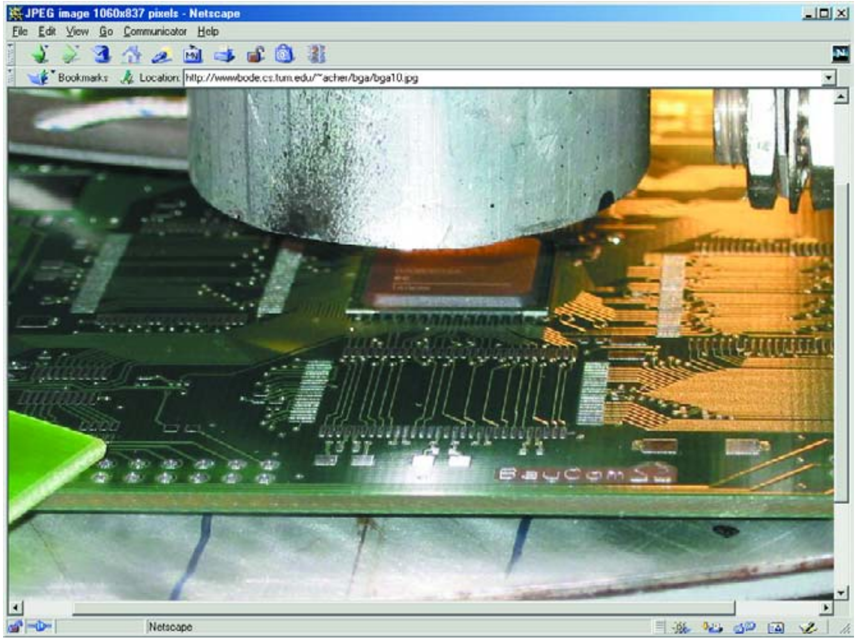
Your smallest components, the resistors and diodes, will need to have their wire leads bent, in order for you to feed them through the holes on the circuit board. Ideally, you want to have a clean looking circuit, and have your components as close to the surface of the circuit board as you can be.

The best way to bend the leads is to take your pliers, and grip the wire a short distance from the side of the component.

Then, take your finger, and push on the component to bend the wire to about a 90-degree angle, this will produce a nice clean bend.

Doing the same thing to the other end will produce a nice clean looking bend, and can now be easily fed through the holes in the circuit board.

When you put the component on the circuit board, you want to get it as close to the board as possible. If there is a lot of extra wire above the surface of the board, there is a better chance of it getting bent, damaged, or broken off.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ponents and cleaning the tip of your iron.

A more general and informative article about soldering may be found at **Electronics Tips: Better Soldering** [3]. Here you find a reprint of information originally published by Coopertools, the manufacturer of the well-known Weller soldering irons and stations. The story supplies details on the different lead/tin ratios used for soldering tin (with the resultant melting points) as well as on the operation of Weller soldering irons.

An excellent step-by-step course in soldering is available at the German-language Elexs website under the name **Der Kleine Lötkurs** parts 1-4 [4]. Even if you can not read German, the photographs alone are well worth visiting the site. The presentation is entirely practice-oriented and clearly laid out.

At [5] we found another website with a soldering course.

Those of you with a deeper interest in the subject or in need of additional information should have a look at **The Educational Encyclopedia** web pages [6]. Here you find a series of links to websites covering soldering and soldering techniques. The same website also offers an extensive collection of links to other subjects in the wide field of electronics.

Advanced techniques such as SMD soldering are also covered in courses. As you probably know, SMDs are miniature components without wires, requiring special soldering methods and materials to secure them on a printed circuit board. At **Soldering SMD** [7] the basic principles of SMD soldering are explained in a manner that's easy to follow.

Those of you with some experience in soldering SMDs may proceed to the next challenge: unsoldering SMDs and mounting new ones on existing PCBs. Rato Electronics provide a richly illustrated set of guidelines at the excellent **How To: SMD Rework** [8] webs pages.

Finally, for Master Class level soldering, we should point you to the website published by **Georg Archer** [9] where you'll find out how to solder your own BGAs (ball grid arrays). The contacts on these ICs are no more than little spheres at the underside of the case that can not be accessed with the tip of a soldering iron. Using some tools and a lot of ingenuity Georg shows you how to solder BGAs 'by hand' despite everyone else telling you it's impossible!

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Internet Addresses

[1] B2ModKits.com: www.b2modkits.com/Resources/Soldering/

[2] Benchmarks: www.mts.net/~rmcgill/

[3] Electronics Tips: Soldering Techniques: www.elexp.com/t_solder.htm

[4] Elexs: Der kleine Lötkurs: www.elexs.de/loet1.htm

[5] A primer on hand soldering electrical connections:
http://et.nmsu.edu/~etti/fall97/electronics/solder.html

[6] The educational encyclopedia, soldering techniques, assembly process:
http://users.pandora.be/educypedia/electronics/soldering.htm

[7] Soldering SMD: www.smdin.com/solderingsmds.html

[8] Rato Elektronica NV - SMD Rework: www.rato.be/nl/smd_rework.htm

[9] DIY BGA Soldering: http://wwwbode.cs.tum.edu/~acher/bga/index.html